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Abstract

Having based on the analysis of Pietronero and collaborators the galaxy number counts can be considered as an evidence of that the geometry of the universe is euclidean and that the K-corrections are absent. In such a universe measuring the cosmological redshift of the object and measuring the flux from the object are inconsistent. It is considered the model of the universe which describes the above properties.

Authors of [1],[2] claimed that galaxies have a fractal distribution with constant $D \approx 2$ up to the deepest scales probed until now 1000 h^{-1} Mpc and may be even more. They showed that modification of the euclidean geometry and the K-corrections are not very relevant in the range of the present data. The use of K-corrections leads to the unstable behaviour of the number counts, with fractal dimension D increasing systematically to substantially larger values as a function of the depth of the volume limited sample. Quantitatively this behaviour can be explained as the effect of K-corrections applied to an underlying galaxy distribution with fractal dimension $D \approx 2$. The use of the FRW geometry instead of the euclidean geometry is equivalent to an effective K-correction. So similar to the use of K-corrections the use of the FRW geometry leads to the unstable behaviour of the number counts as a function of depth.

The number counts can be considered as an evidence of that the geometry of the universe is euclidean rather than FRW and that the K-corrections are spurious. Let us study the universe with euclidean geometry. It should be noted that here euclidean geometry is conceived as a real background of the universe not as an approximation of the FRW geometry.

In the euclidean geometry, the radial distance r and the angular diameter distance r_θ are the same and are given by

$$r = r_\theta = \frac{c}{H_0}\frac{z}{1+z}. \tag{1}$$

The luminosity distance is given by

$$r_{\mathrm{L}} = r(1+z) = r_\theta(1+z) = \frac{c}{H_0}z. \tag{2}$$

From this it follows that the intrinsic luminosity of the object L and the observed flux F are related as

$$F \propto \frac{L}{r_{\mathrm{L}}^2} \propto \frac{L}{r^2(1+z)^2} \propto \frac{L}{r_\theta^2(1+z)^2}. \tag{3}$$

In the case of FRW geometry, the intrinsic luminosity of the object L and the observed flux F are related as

$$F \propto \frac{L}{r_{\mathrm{L}}^2} \propto \frac{L}{r_\theta^2(1+z)^4}. \tag{4}$$

Two factors $1+z$ are due to the increase of the scale factor. The third factor $1+z$ is due to the decrease of the frequency of photon. The fourth factor $1+z$ is due to that the time goes faster. The two of four factors $1+z$ are absent in the case of euclidean geometry. This is natural to interprete such that the scale factor grows, the frequency of photon is constant, and the flow of time is constant. Since the frequency of photon is constant, K-corrections are absent. Thus in the universe with the euclidean geometry the K-corrections are absent.

We arrive at the situation where there are two inconsistent types of observations. The first, when the scale factor do not grow with time $a = const$, and the clock goes faster with time $\Delta t \propto 1+z$ and correspondingly the frequency of photon decreases with time $\omega \propto (1+z)^{-1}$. The second, when the scale factor grows with time $a \propto 1+z$, and the clock goes persistent with time $\Delta t = const$ and correspondingly the frequency of photon is constant with time $\omega = const$. Below we consider the model of the universe with such properties.

In the FRW model [3], the universe is considered in the system accompanying to the matter of the universe. On the contrary, let us consider the universe in the laboratory system. It should be stressed that here we consider the model of the universe in the laboratory system not as an approximation of the FRW model but as a real one. Let the universe be close. The total mass of the close universe in the laboratory system is equal to zero. Hence, when considering the close universe in the laboratory system, the gravity (matter) of the universe do not define the evolution of the universe.

So we consider the close universe in the laboratory system. Let the scale factor of the universe be equal to the size of the horizon at every moment of time

$$a = ct. \tag{5}$$

The law (5) can be treated in two ways. The first, the clock goes persistent with time $\Delta t = const$, and the scale factor of the universe grows with time $a \propto t$. The second, the scale factor is constant with time $a = const$, and the clock goes faster with time $\Delta t \propto t$. Thus it is impossible to define simultaneously the growth of the scale factor and the acceleration of the flow of time. The evolution of the universe can be expressed either as a growth of the scale factor or as an acceleration of the flow of time. Hence there are two inconsistent types of observations.

Measuring the cosmological redshift of the object corresponds to the second type. In this case the scale factor of the receiver and the scale factor of the emitter are the same $a_r = a_e$. The clock of the receiver goes faster than the clock of the emitter $\Delta t_r = \Delta t_e(1+z)$, and the spectral line of the receiver is redshifted from the spectral line of the emitter $\omega_e = \omega_r(1+z)$.

Measuring the photon flux from the object through the photometric band corresponds to the first type. In this case the scale factors of the receiver and the scale factor of the emitter are related as $a_r = a_e(1+z)$. The clock of the receiver and the clock of the emitter go concurrently, and the frequency of photon for the receiver and for the emitter is the same $\omega_r = \omega_e$. Hence the observed flux is a function of redshift $F \propto r_\theta^{-2}(1+z)^{-2}$, and the K-corrections are absent.

Thus describing the universe in the laboratory system we come to the conclusion that the geometry of the universe is euclidean and that the K-corrections are absent. This is in agreement with the observed galaxy number counts. It should be noted that there is no evidences in favour of the use of the system accompanying to the matter of the universe for description of the universe. So the number counts can be considered as an evidence in favour of the use of the laboratory system for description of the universe.

The observed behaviour of the number counts is $D \approx 2$. Description of the universe in the laboratory system leads to the fractal structure $D = 2$ [4]. Sketch how the fractal structure arises in this case. So we consider the close universe in the laboratory system. For the close universe the mass of the matter is equal to the energy of selfgravity

$$mc^2 = \frac{Gm^2}{a}. \tag{6}$$

From this substituting the law (5) it follows that the scale of mass grows with time

$$m = \frac{c^2}{G}a = \frac{c^3}{G}t. \tag{7}$$

Let photon be emitted from the centre of the laboratory system. Then the motion of photon defines the distance $R = ct$. Since the scale of mass grows with time, it grows with the distance from the centre of the laboratory system $m \propto t \propto R$. The number of the particles of the mass M within radius R is given by

$$N(< R) = \frac{\rho R^3}{M} \propto R^2. \tag{8}$$

Thus the growth of the scale of mass with time defines the fractal structure of the universe.

References

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